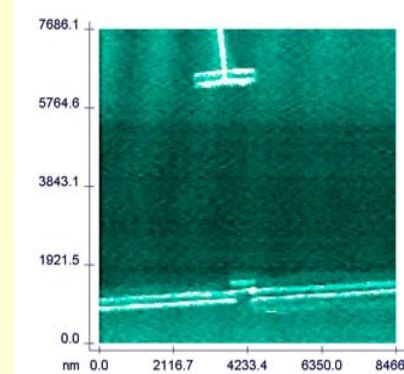
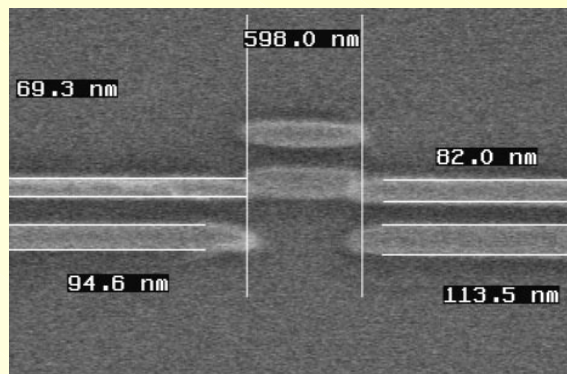


# *Spin Transport and Dynamics in Nanoscale Hybrid Structures*

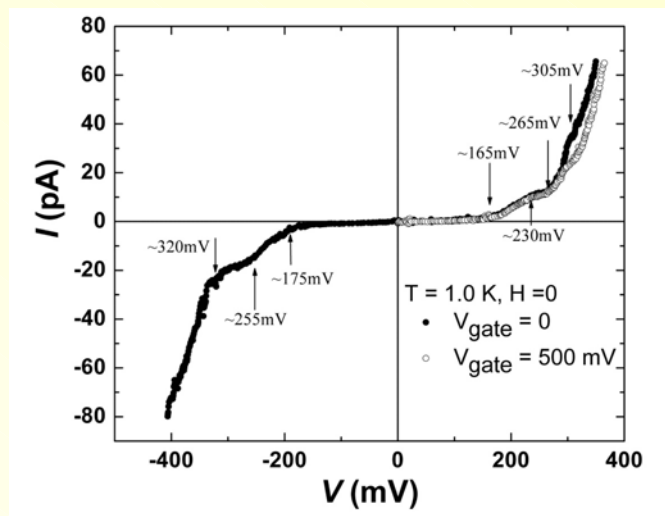
**DMR - 0103302**

**PI:** J.G. Lu, UC Irvine; **Co-PIs:** S.X Wang, Stanford;  
R.C. O'Handley, MIT; J.S. Moodera, MIT Francis Bitter Magnet Lab

The objective of this project is to fabricate and characterize nanoscale hybrid junction structures that will reveal new physical aspects of quantum states and dynamic behavior of electron spins. Several interesting effects have been predicted for spin-dependent transport in ferromagnetic single electron transistors (FMSET), such as spin accumulation, spin relaxation, and magnetoconductance oscillations. Our goal is to experimentally verify these theoretical predictions and develop versatile spin electronic devices using single-electron spin as a binary variable, which so far is being pursued based on the behavior of large numbers of spin-polarized electrons.



SEM and AFM images of double angle evaporated FMSET with Al as the island and Ni as the FM electrodes. Its I-V characteristic is shown below.



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## **Education:**

In this NIRT team, there are a total of six graduate students trained in the program and have presented papers at conferences. Three postdocs (partially funded from this program) have been involved. Five undergraduates have participated in the research. Two of the undergraduates have gone on to graduate study in materials physics having won the NSF National Graduate Fellowship.

## **Outreach:**

Eight high school students have participated in the last three years of the research program. The students have won many scientific competitions, such as those sponsored by Intel and Siemens, including top awards, and proceeded to state-level school competitions. Many of them have been admitted to top universities such as MIT, Harvard and Stanford.